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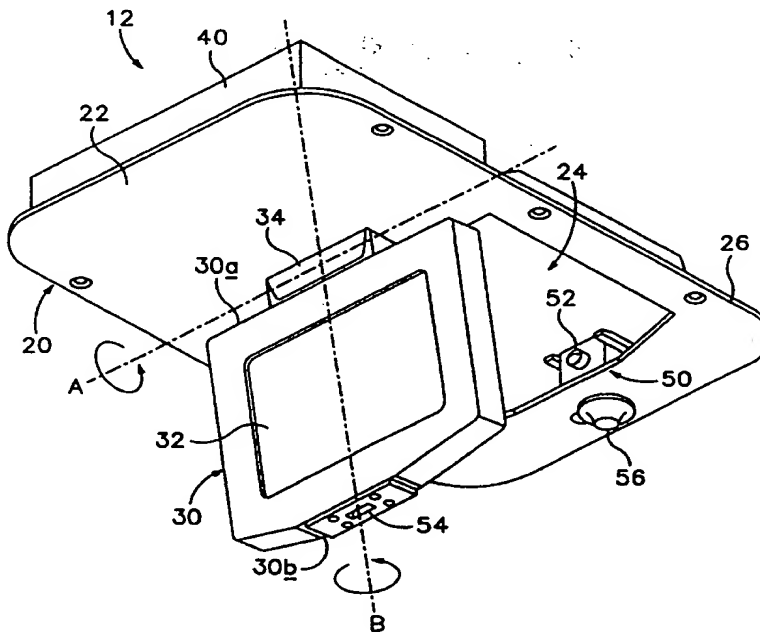
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(71)(72) Applicant and Inventor: ROSEN, John, B. [US/US]; 87580 Cherry Ridge Road, Eugene, OR 97402 (US).		
(74) Agents: KOLISCH, J., Pierre et al.; Kolisch, Hartwell, Dickinson, McCormack & Heuser, Suite 200, 520 S.W. Yamhill Street, Portland, OR 97204 (US).		
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(54) Title: DISPLAY UNIT



## (57) Abstract

A display unit (12) is provided, the display unit including a housing (20) configured for mounting in an interior region of a vehicle, and a screen (30) mounted on the housing for movement between a stowed position wherein the screen is at least partially contained within the housing and a deployed position wherein the screen projects from the housing to reveal a viewing surface (32) of the screen. When the screen is deployed, the viewing surface typically is at an angle of between 45-degrees and 90-degrees from the stowed position.

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## DISPLAY UNIT

### Technical Field

The present invention relates generally to display units, and more particularly, to a display unit configured for use in presenting a viewing surface to  
5 occupants of a vehicle.

### Background Art

Automotive manufacturers have long sought to make passengers as comfortable as possible during travel, focusing both on physical comfort and on the passenger's entertainment. For example, vehicle sound systems have become standard  
10 accessories in most cars and trucks. In recent years, efforts have involved attempts to bring video technology into the passenger compartment, either in the form of a television, a computer, or a video game display.

Unfortunately, display units have heretofore been impractical as automotive accessories due to problems in mounting conventional display units within  
15 a vehicle. One problem relates to the size of most display units, it being difficult to find space for a standard-size monitor in most vehicles. Another problem arises from difficulties in placing the display unit in a position where it may be viewed by a passenger, but will not obstruct the driver's view of the road. Still another problem involves the stowability of the display unit, and its corresponding effect on passenger  
20 safety.

Known display units also have been unable to meet consumer expectations due to difficulties in providing acceptable picture quality in a package of suitable size. However, with advancements in flat-panel display technology, picture

quality of smaller display units has improved dramatically. Additionally, it has become possible to separate some of the electronic circuitry from the flat-panel display, further reducing the thickness of these displays. The present invention takes advantage of these improvements by providing a stowable display unit which is suited  
5 for mounting in an interior region of an automobile without compromising picture quality.

### Disclosure of the Invention

The aforementioned goals and objectives are met by provision of a display unit which includes a housing configured for mounting in an interior region of  
10 a vehicle, and a screen mounted on the housing for movement between a stowed position wherein the screen is at least partially contained within the housing and a deployed position wherein the screen projects from the housing to reveal a viewing surface of the screen. When the screen is deployed, the viewing surface typically is at an angle of between approximately 45-degrees and 90-degrees from horizontal,  
15 promoting viewability of the screen.

In one embodiment, the housing is mounted on the ceiling of the vehicle, typically near the center of the passenger compartment. The screen is mounted on the housing for pivot about a first axis which typically is defined along a predetermined edge of the screen. The screen pivots between a first orientation wherein the screen is  
20 generally horizontal (the stowed position), and a second orientation wherein the screen extends downwardly from the ceiling to present the screen's viewing surface to one or more vehicle occupants (the deployed position). The screen also may be pivotal about a second axis, transverse to the first axis, so as to enhance adaptability of the screen.

A cavity of predetermined shape and size is formed in the housing, the cavity being configured to at least partially contain the screen. This reduces the profile of the display unit when the unit is not in use. The profile may be reduced further by mounting the screen's control module separately from the screen, leaving a relatively thin pivotal screen. Where the cavity is embedded in the ceiling, the screen may be configured to retract entirely into the cavity such that the viewing surface is flush with the ceiling. This eliminates any impediment to the driver's view when the screen is in its stowed position.

The housing also may include a track, and a carriage which rides along the track to provide for deployment of the screen. In such an arrangement, the screen is mounted on the carriage for deployment first, by translation of the screen along the track from a first stowed position to an intermediate position, and second, by pivot of the screen about a first axis from the intermediate position to a deployed position. Again, the first axis preferably is defined along a predetermined edge of the screen.

Safety may be enhanced by provision of a break-away hinge which pivotally couples the screen with the housing to provide for emergency collapse of the screen. Such a screen preferably is pivotal in a forward direction between the stowed position and the deployed position under a first torque so as to deploy the screen, and is further pivotal in the forward direction between the deployed position and a break-away position under a higher second torque.

These and other objects and advantages of the present invention will be more readily understood after a consideration of the drawings and the detailed description of the preferred embodiment which follows.

### Brief Description of the Drawings

Fig. 1 is an isometric view of a display unit constructed in accordance with the present invention, the display unit including a screen shown in a stowed position.

5 Fig. 2 is an isometric view similar to that of Fig. 1, but with the screen pivoted to a deployed position.

Fig. 3 is a side view of the display unit shown in Figs. 1 and 2.

Fig. 4 is a somewhat simplified side view of a vehicle interior illustrating use of the display unit depicted in Figs. 1, 2 and 3.

10 Fig. 5 is a sectional side view of a first alternative embodiment display unit, the display unit screen being shown in successive positions by dashed lines.

Fig. 6 is an isometric view of a second alternative embodiment display unit, the display unit including a screen in a stowed position.

15 Fig. 7 is a side view of the display unit of Fig. 6, but with the screen in an intermediate position.

Fig. 8 is an isometric view of the display unit of Fig. 6, but with the screen in a deployed position.

20 Fig. 9 is an end view of the display unit of Fig. 6, the screen being deployed to reveal a track, carriage and hinge arrangement for use in deploying the screen.



Detailed Description of the Preferred Embodiment  
and Best Mode of Carrying Out the Invention

Referring initially to Figs. 1 through 4, a display unit is shown for use in an interior region of a land vehicle 10, such display unit being indicated generally at 12. Although the invention has broad utility, the display unit is shown mounted on the ceiling 10a of the vehicle, preferably overhead and generally forward of the of the passenger seating area 14 so as to accommodate viewing thereof by one or more rear-seat passengers P.

The display unit includes a generally planar mounting frame structure in the form of a housing 20, and a corresponding screen 30, which is mounted on the housing for movement between a stowed position (Fig. 1) and a deployed position (Fig. 2). In the stowed position, the screen is contained within the housing, a viewing surface 32 thereof typically facing downward into the passenger compartment. In the deployed position, the screen projects from the housing to present the screen's viewing surface to rear-seat passenger P. The screen's viewing surface thus selectively is placed in the rear-seat passenger's line-of-sight 16.

In accordance with my teachings, housing 20 will be seen to include a perimeter structure 22 having a proximal portion closer to the passenger seating area and a distal portion more remote from the passenger seating area. The housing defines a cavity 24 configured to receive the screen when the screen is placed in its stowed position. The cavity is of predetermined shape and size, typically conforming substantially to the shape and size of the viewing screen. It will be noted in Figs. 1

and 2, for example, that cavity 24 is configured to accommodate fitted receipt of screen 30 such that the screen is fully contained within the cavity.

The housing typically is embedded in the ceiling, the vehicle being provided with a ceiling recess configured for receipt of the housing. Accordingly, the  
5 perimeter structure includes a generally planar flange 26 which may be secured to the ceiling via conventional fasteners such as screws. The flange is configured to conform to the contour of the ceiling, and preferably defines the lowermost surface of the housing. The housing thus may be flush-mounted with the ceiling. Furthermore, when the screen is in its stowed position with the screen contained within the cavity,  
10 the screen's viewing surface is flush with the flange, and correspondingly, is flush with the vehicle's ceiling.

In the depicted embodiment, the screen is separated from a video control module 40 which directs operation of the screen. The control module typically is mounted on the perimeter structure beside the screen and is connected to the screen  
15 via a ribbon wire or the like. This keeps the display unit relatively thin. In the depicted embodiment, for example, the display unit is approximately 1/2-inch to 1 1/2-inches thick.

As indicated, viewing screen 30 is hinged to the housing adjacent the distal portion thereof to accommodate reversible swaying thereof in an upright plane  
20 which extends both through the housing and through the passenger seating area. The screen thus is deployed by pivot thereof about a first axis A which corresponds generally to a first edge 30a of the screen. To deploy the screen, the screen is pivoted in a rearward direction to a deployed position where the screen is at an angle  $\theta$  from

horizontal. In the depicted embodiment,  $\theta$  is within a range of between approximately 45-degrees and 90-degrees. This presents the screen's viewing surface to rear-seat passenger P. The screen also may be retracted to its stowed position, again by pivot of the screen about axis A. Pivot occurs about a hinge which is shown generally at 34.

5           The screen also is pivotal about a second axis B which is transverse to first axis A. Accordingly, the screen is adjustable by side-to-side rotation of the screen so as to selectively face the screen's viewing surface toward a rear-seat passenger. The screen's viewing surface thus may selectively be placed in the rear-seat passenger's line of sight.

10           The display unit also employs a locking mechanism which selectively maintains the screen in its stowed position. The locking mechanism includes a catch 52 mounted on the housing and configured to selectively engage a corresponding recess or detent 54 in the screen's second edge 30b. The locking mechanism is operable via a lever 56 which extends (and retracts) the catch for capture (and release)  
15 by recess.

A first alternative embodiment display unit is shown at 112 in Fig. 5, the alternative display unit differing from display unit 12 primarily by its provision of a break-away screen 130. The screen is mounted on a display unit housing 120, typically for pivot between a stowed position and a deployed position to present a  
20 viewing surface 132 to a passenger in the passenger viewing area.

As indicated, display unit 112 is suited for use in a vehicle 10, the display unit typically being embedded in the vehicle ceiling with housing 120 flush-mounted on ceiling 10a. The screen is hingedly attached to the housing via break-

away hinge 134 for pivot between a generally horizontal first orientation wherein the screen is at least partially contained within cavity 124, and a second orientation wherein the screen extends downwardly from the cavity to present the screen's viewing surface to a vehicle occupant for viewing.

5 In its first orientation (shown in solid lines), screen 130 is in a stowed position where the screen is contained within cavity 124, the screen's viewing surface facing upwardly into the cavity so as to protect the viewing surface from damage. The screen is stowed adjacent control module 140, and may be locked in place by locking mechanism 150.

10 Upon deployment, the screen is pivoted under a first torque from its first orientation (shown in solid lines at 130) to its second orientation (shown in dashed lines at 130') where the screen is in a deployed position with the screen extending downwardly from the ceiling at an angle  $\alpha$  of between approximately 45-degrees and 90-degrees. The screen thus is pivoted through an angle  $\phi$  which is between  
15 approximately 90-degrees and 135-degrees. The screen's viewing surface 132' faces rearwardly and downwardly toward the vehicle's rear-seat passengers.

Upon application of a second, higher torque, the screen may be pivoted from the second orientation (shown in dashed lines at 130') to its third orientation (shown in dashed lines at 130'') where the screen rests against the housing in a break-  
20 away position. This is accomplished via a two-phase hinge 134 which defines a first range of motion (between the first and second orientations) wherein the screen pivots upon application of a first torque, and a second range of motion (between the second and third orientations) wherein the screen pivots upon application of a higher second

torque. As will be appreciated by those skilled in the art, the change in torque creates a soft stop with the screen in the second orientation, a feature which provides for quick deployment of the screen.

The ability of the screen to pivot to the third orientation serves as a  
5 safety feature, the screen effectively being configured to collapse in the event of an emergency. It will be understood, for example, that the depicted screen will pivot forward from the second orientation upon contact by a rear-seat passenger who is thrown forward in a collision, but only upon application of a predetermined threshold force. Similarly, the screen is configured to pivot toward the rear of the vehicle upon  
10 application of an opposite force. In either event, the screen will yield upon application of sufficient force, and thus will not act as a hard stop of the type which may cause injury to vehicle occupants.

Figs. 6 through 9 show a second alternative embodiment of the invented display unit at 212, such display unit being adapted for use in a vehicle having a  
15 sunroof or the like. It will be noted that the display unit includes a surface-mounted housing 220. The housing defines a cavity 224 which is configured to house a screen 230 having a viewing surface 232. The screen may be deployed to reveal the viewing surface, typically first by translation in a plane defined by the screen, and second by pivot about an axis defined by hinge 234. The screen thus typically is mounted on a  
20 carriage 236 for translation along a track 238. The hinge is positioned along a predetermined edge of the screen to provide for pivot of the screen once it has been removed from the cavity.

In Fig. 6, the screen is shown in its first position where the screen is contained within the cavity in a generally horizontal orientation. From the first position, the screen is translated along track 236 to an intermediate position with the screen still in the generally horizontal orientation. Fig. 7 shows the screen in the intermediate position. Thereafter, the screen is pivoted about a first axis A to a second position where the screen extends downwardly from the cavity to present the screen to a vehicle occupant for viewing. Fig. 8 shows the screen in the second position. The screen also may be rotatable about a second axis B which is transverse to the first axis.

The screen is configured to pass forwardly in the vehicle along track 236, and then to pivot rearwardly to the deployed orientation under a predetermined first torque. The screen typically will pivot downstream to an angle of between approximately 45-degrees and 90-degrees from horizontal such that the viewing surface may be readily seen by rear-seat passengers. It is possible, however, to provide for further downstream pivot of the screen under a higher second torque to provide for emergency collapse of the screen.

While the present invention has been shown and described with reference to the foregoing operational principles and preferred embodiment, it will be apparent to those skilled in the art that other changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

## I CLAIM:

1. An automotive display unit comprising:  
an embedded housing configured for mounting in an interior region of an automobile, the housing defining a cavity of predetermined shape and size; and  
a screen, also of such predetermined shape and size, the screen having a viewing surface and being mounted on the housing for movement between a stowed position wherein the screen is at least partially contained within the cavity of the housing, and a deployed position wherein the screen pivotally projects from the cavity of the housing to present the viewing surface to an automobile occupant.
2. The automotive display unit of claim 1, wherein the screen is pivotal about a first axis defined along a predetermined edge of the screen to effect pivotal movement of the screen between the stowed position and the deployed position.
3. The automotive display unit of claim 2, wherein the screen is rotatable about a second axis which is transverse to the first axis.

4. The automotive display unit of claim 1, wherein the housing includes a track which extends from the cavity, and a corresponding carriage which rides along the track, the screen being pivotally mounted on the carriage to provide for deployment of the screen.

5. The automotive display unit of claim 4, wherein the screen is pivotal about a first axis defined along a predetermined edge of the screen, and the screen is rotatable about a second axis transverse to the first axis.

6. The automotive display unit of claim 1, wherein the screen includes a hinge pivotally coupling the screen with the housing, the screen being pivotal about the hinge between the stowed position and the deployed position under a first torque to provide for deployment of the screen, and being pivotal between the deployed position and a break-away position under a higher second torque to provide for emergency collapse of the screen.



7. The automotive display unit of claim 6, wherein the screen pivots forwardly in the vehicle from the stowed position to the deployed position, and further pivots forwardly in the vehicle from the deployed position to the break-away position.

8. The automotive display unit of claim 1, wherein the screen is mounted on a ceiling of the automobile.

9. The automotive display unit of claim 8, wherein the viewing surface defines a plane generally parallel to the ceiling when the screen is in the stowed position.

10. The automotive display unit of claim 8, wherein the viewing surface is at an angle of between approximately 45-degrees and 90-degrees from horizontal when the screen is in the deployed position.

11. The automotive display unit of claim 1, wherein the housing is embedded in a ceiling of the automobile.

12. The automotive display unit of claim 11, wherein the housing includes a perimeter structure with a flange configured for placement against the ceiling to define a cavity opening, the screen being mounted on the housing such that the viewing surface lies generally flush with the flange when the screen is in the stowed position.

13. The automotive display unit of claim 1, which further comprises a locking mechanism with a catch mounted on the housing to selectively engage the screen for maintaining the screen in the stowed position.

14. The automotive display unit of claim 1 which further comprises an control module mounted separately from the screen, the control module being operatively connected to the screen to direct operation thereof.

15. An overhead display unit for use in a land vehicle, the display unit comprising:

a housing configured for attachment to a ceiling of a land vehicle, the housing defining a cavity of predetermined shape and size; and

a generally planar screen, also of such predetermined shape and size, the screen having a viewing surface and being hingedly attached to the housing for pivot about a first axis between a generally horizontal first orientation wherein the screen is at least partially contained within the cavity, and a generally vertical second orientation wherein the screen extends downwardly from the cavity to present the screen to a land vehicle occupant for viewing.

16. The overhead display unit of claim 15, wherein the screen includes a hinge defined along a predetermined edge of the screen to provide for forward pivot of the screen from the first orientation to the second orientation, and to further provide for forward pivot of the screen from the second orientation to a generally horizontal third orientation.

17. The overhead display unit of claim 16, wherein the screen is pivotal about the hinge from the first orientation to the second orientation under a first torque to provide for deployment of the screen, and is pivotal about the hinge from the second orientation to the third orientation under a higher second torque to provide for emergency collapse of the screen.

18. The overhead display unit of claim 15, wherein the screen is rotatable about a second axis which is transverse to the first axis.

19. The overhead display unit of claim 15, wherein the housing is embedded in the ceiling such that the screen lies generally flush with the ceiling when the screen is in the first orientation.

20. The overhead display unit of claim 15, wherein the viewing surface is at an angle of between approximately 45-degrees and 90-degrees from horizontal when the screen is in the second orientation.

21. The overhead display unit of claim 15, which further comprises a locking mechanism with a catch mounted on the housing to selectively engage a detent in the screen for maintaining the screen in the first orientation.

22. The overhead display unit of claim 15 which further comprises a control module mounted separately from the screen, the control module being operatively connected to the screen to direct operation thereof.

23. An overhead display unit for use in a land vehicle, the display unit comprising:

a housing configured for attachment to a ceiling of a land vehicle, the housing defining a cavity of predetermined shape and size, and further including a track and a corresponding carriage which rides along the track; and

a generally planar screen, also of such predetermined shape and size, the screen being pivotally mounted on the carriage to provide for deployment of the screen first by translation of the screen along the track between a first position wherein the screen is at least partially contained within the cavity in a generally horizontal orientation and an intermediate position with the screen still in the generally horizontal orientation, and second by pivot of the screen about a first axis from the intermediate position to a second position wherein the screen extends downwardly from the cavity in a generally vertical orientation to present the screen to a land vehicle occupant for viewing.

24. The overhead display unit of claim 23, wherein the screen includes a hinge defined along a predetermined edge of the screen to provide for forward pivot of the screen from the generally horizontal orientation to the generally vertical orientation, and to further provide for forward pivot of the screen from the generally vertical orientation to a downstream generally horizontal orientation.

25. The overhead display unit of claim 24, wherein the screen is pivotal about the hinge from the generally horizontal orientation to the generally vertical orientation under a first torque to provide for deployment of the screen, and is pivotal about the hinge from the generally vertical orientation to the downstream generally horizontal orientation under a higher second torque to provide for emergency collapse of the screen.

26. The overhead display unit of claim 23, wherein the screen is rotatable about a second axis which is transverse to the first axis.

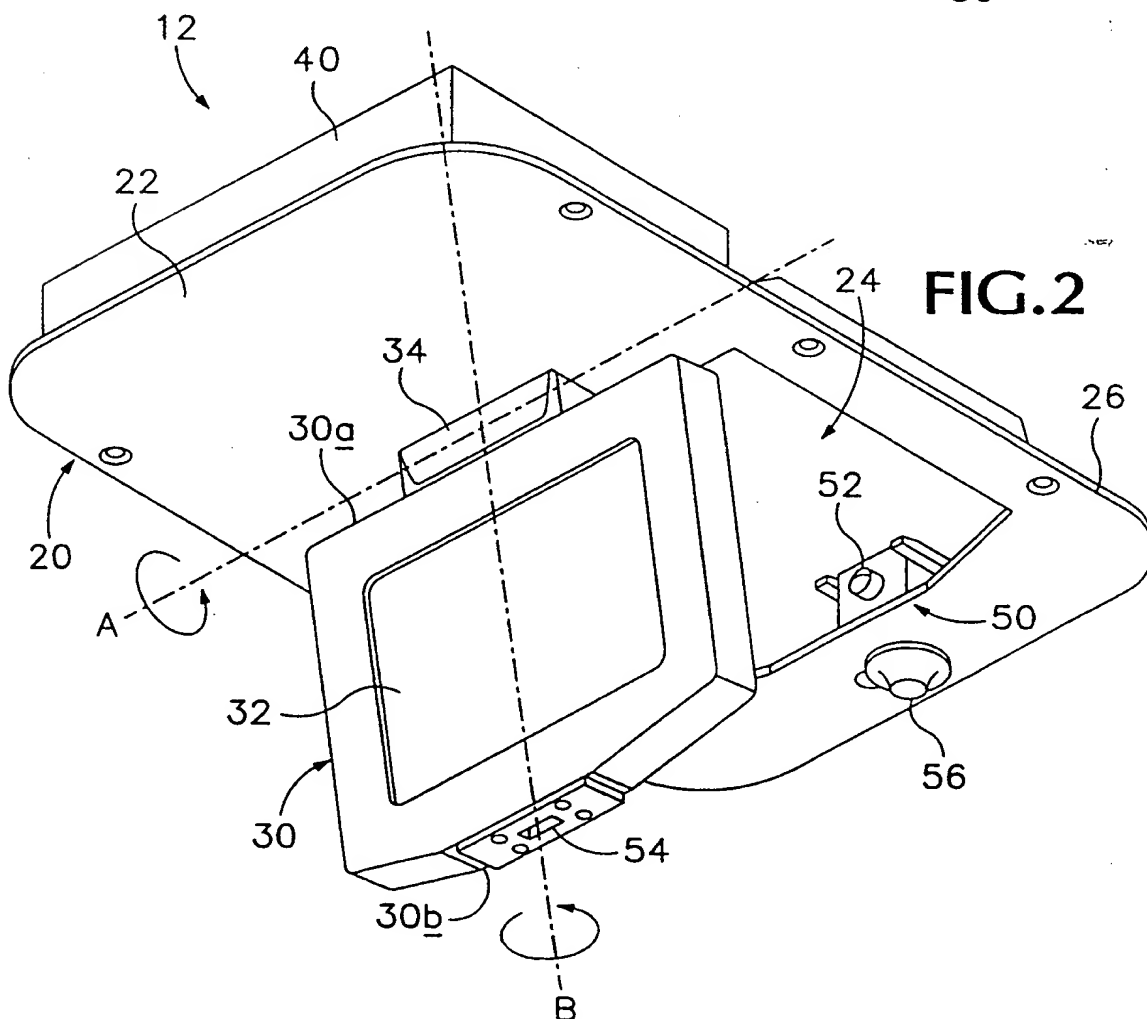
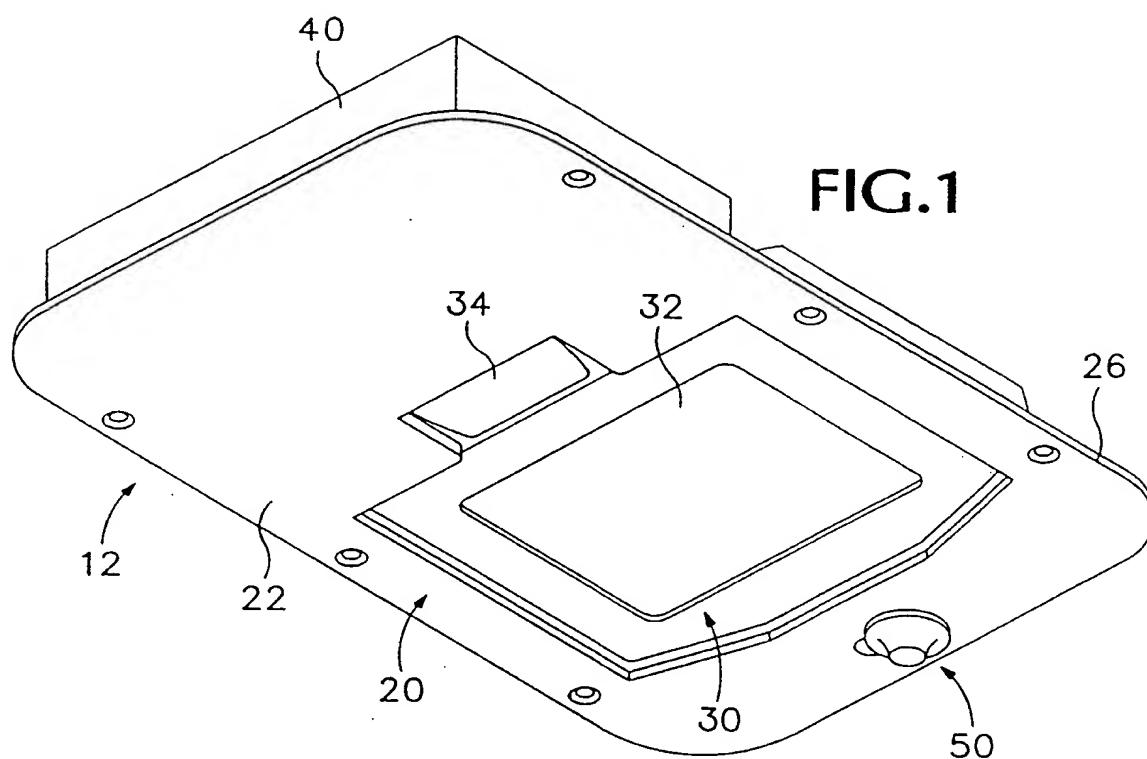
27. The overhead display unit of claim 23, wherein the viewing surface is at an angle of between approximately 45-degrees and 90-degrees from horizontal when the screen is in the generally vertical orientation.

28. An above-seat-level, ceiling-mounted display unit for a land vehicle having a passenger seating area and a generally planar ceiling, the display unit comprising:

a generally planar mounting frame structure joined with the ceiling in a location overhead and generally forward of the passenger seating area in the land vehicle, the mounting frame structure being joined generally co-planarly with the ceiling and having a proximal portion closer to the passenger seating area and distal portion more remote from the passenger seating area; and

a generally planar screen structure hinged to the mounting frame structure adjacent the distal portion thereof for reversibly swaying in an upright plane, extending both through the mounting frame structure and the passenger seating area, between a stowed position wherein the screen structure lies in a plane generally paralleling the plane of the mounting frame structure and a deployed position wherein the screen structure occupies a generally upright plane which lies at an angle relative to the plane of the mounting-frame structure with a disposition overhead-viewable by any passenger seated in the passenger seating area.





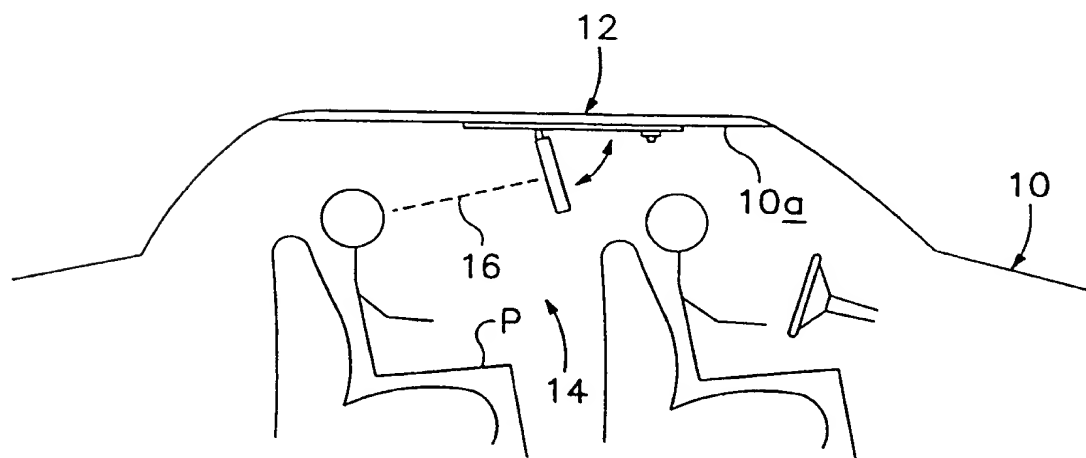
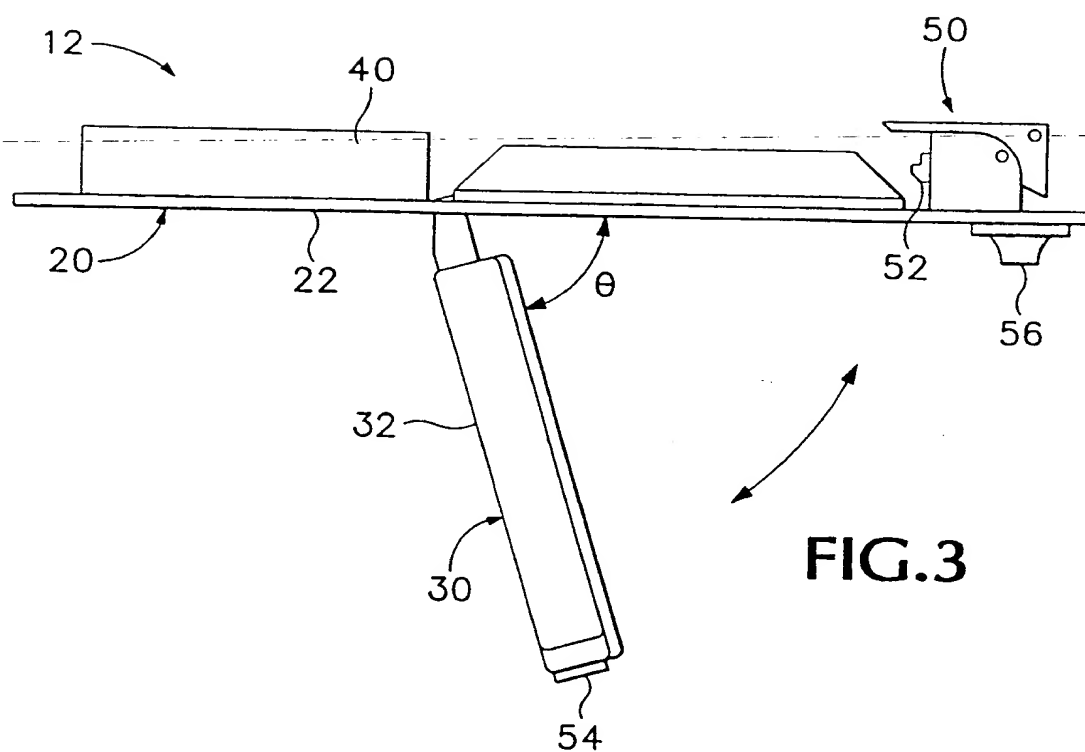


FIG. 4

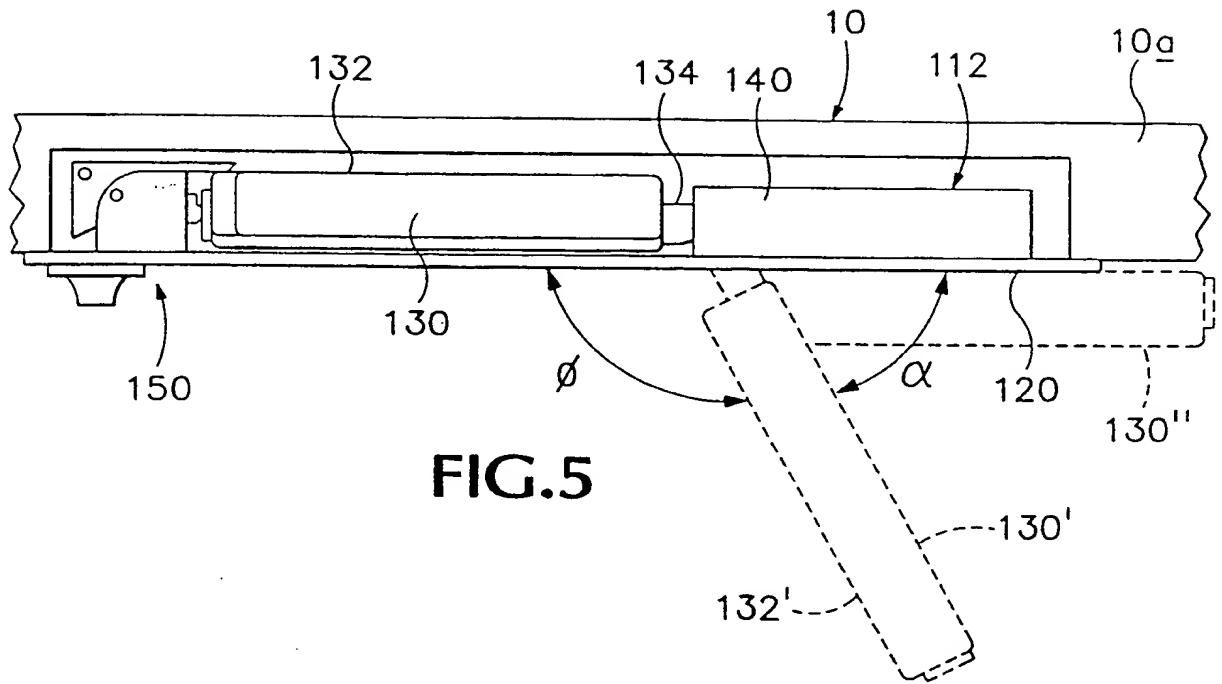


FIG. 5

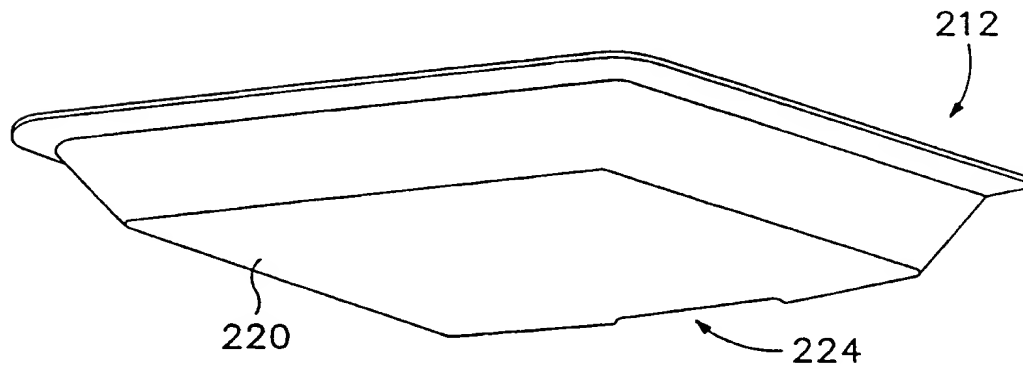
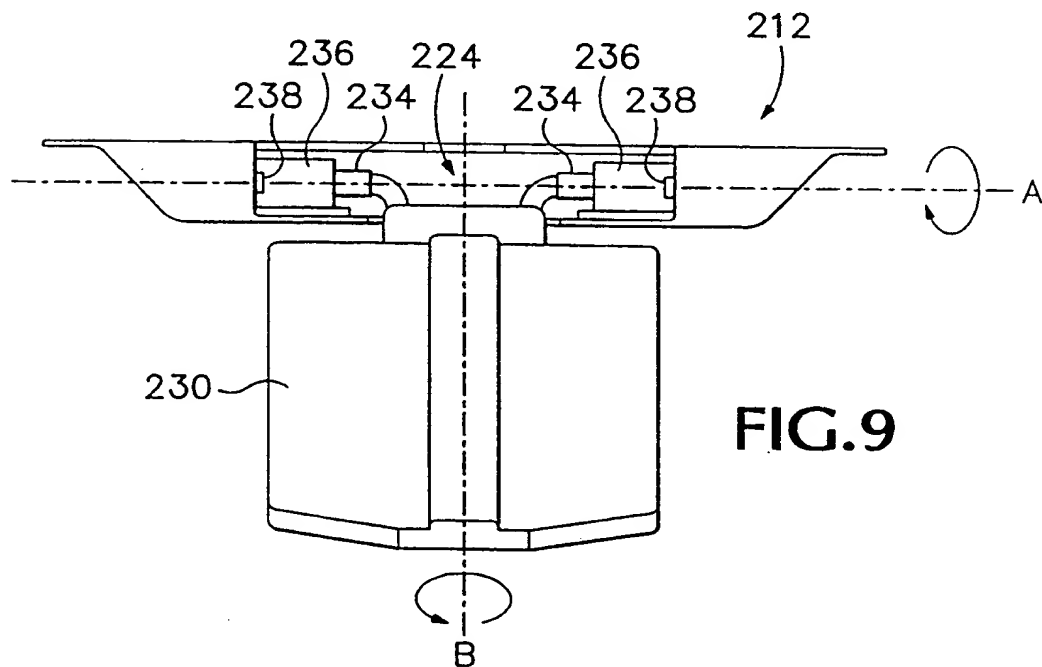
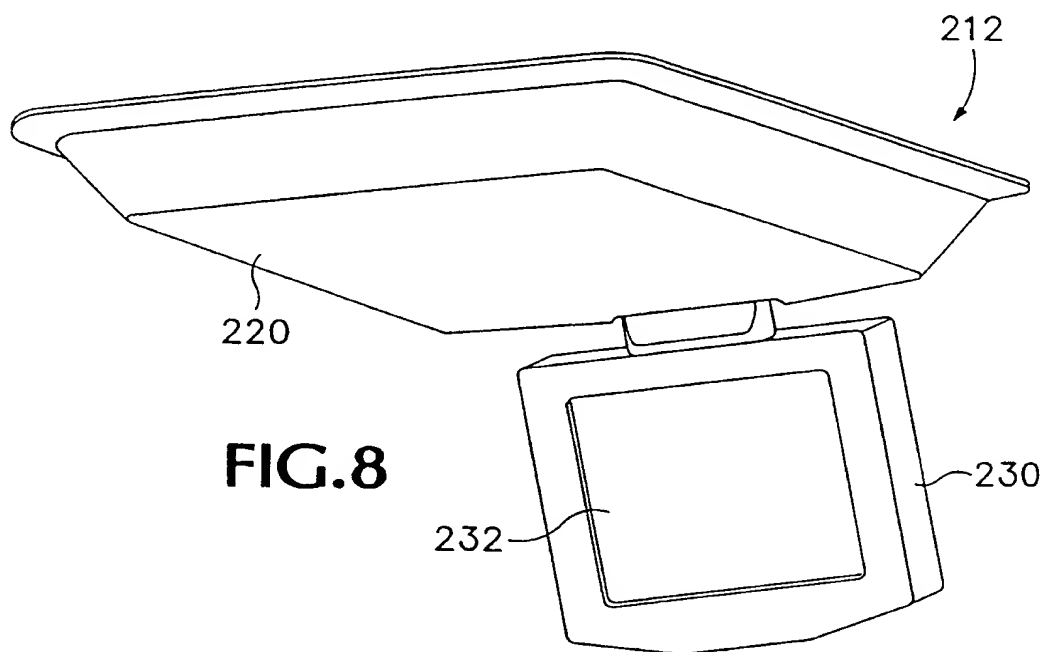
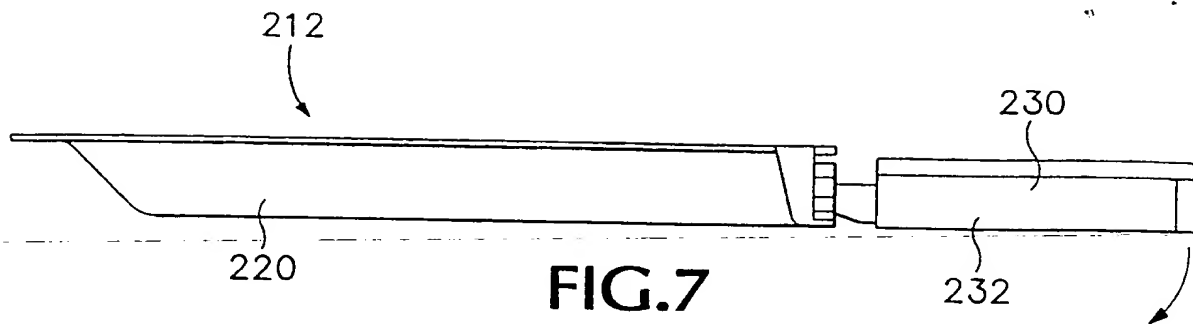


FIG. 6



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US98/13285

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H04N 05/64

US CL : 348/837

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 348/837; 312/7.2; 224/311; 361/681, 726; 296/37.8; 345/905; 455/345

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 5,583,735 A (PEASE et al) 10 December 1996 (10/12/96), all.	1, 2, 13-15, 19-22, 28 ----- 3, 18
X, P	US 5,743,487 A (RICE) 28 April 1998 (28/04/98), all.	1, 2, 14, 15, 19, 20, 22
X --- Y	DE 4,118,711 A (SCHANZER et al) 10 December 1992 (10/12/92), all.	1, 2, 11, 14, 15, 20, 22 ----- 3, 18
Y	JA 5,050,883 A (KANI) 02 March 1993 (02/03/93), all.	3, 18



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

24 AUGUST 1998

Date of mailing of the international search report

07 OCT 1998

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231  
Facsimile No. (703) 305-3230

Authorized officer

GERALD ANDERSON

Telephone No. (703) 308-2168

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/13285

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,096,271 A (PORTMAN) 17 March 1992 (17/03/92), all.	1,2 , 14, 15, 19, 20, 22
Y	US 5,333,416 A (HARRIS et al) 02 August 1994 (02/08/94), all.	3, 18

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/13285

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-3, 11-15, 18-22, 28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/13285

## BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

Figure 1, Figure 5 and Figure 8 respectively.

The claims are deemed to correspond to the species listed above in the following manner:

Figure 1 relates to claims 1-3, 4-15 18-22 and 28

The following claim is generic: 15

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: in Figure 5 the screen slides along a track and in Figure 8 the housing is not embedded in mounting surface.